

# The Holometer

## Installation Progress T1007 ==> E990

Fermilab All Experimenters Meeting

November 14, 2011

Chris Stoughton for The Holometer

**Fermilab:** Aaron S. Chou (co-PI), Hank Glass, Gaston Guitierrez, Craig Hogan, Jason Steffen, Chris Stoughton, Ray Tomlin, Jim Volk, William Wester

**MIT LIGO:** Sam Waldman, Rai Weiss

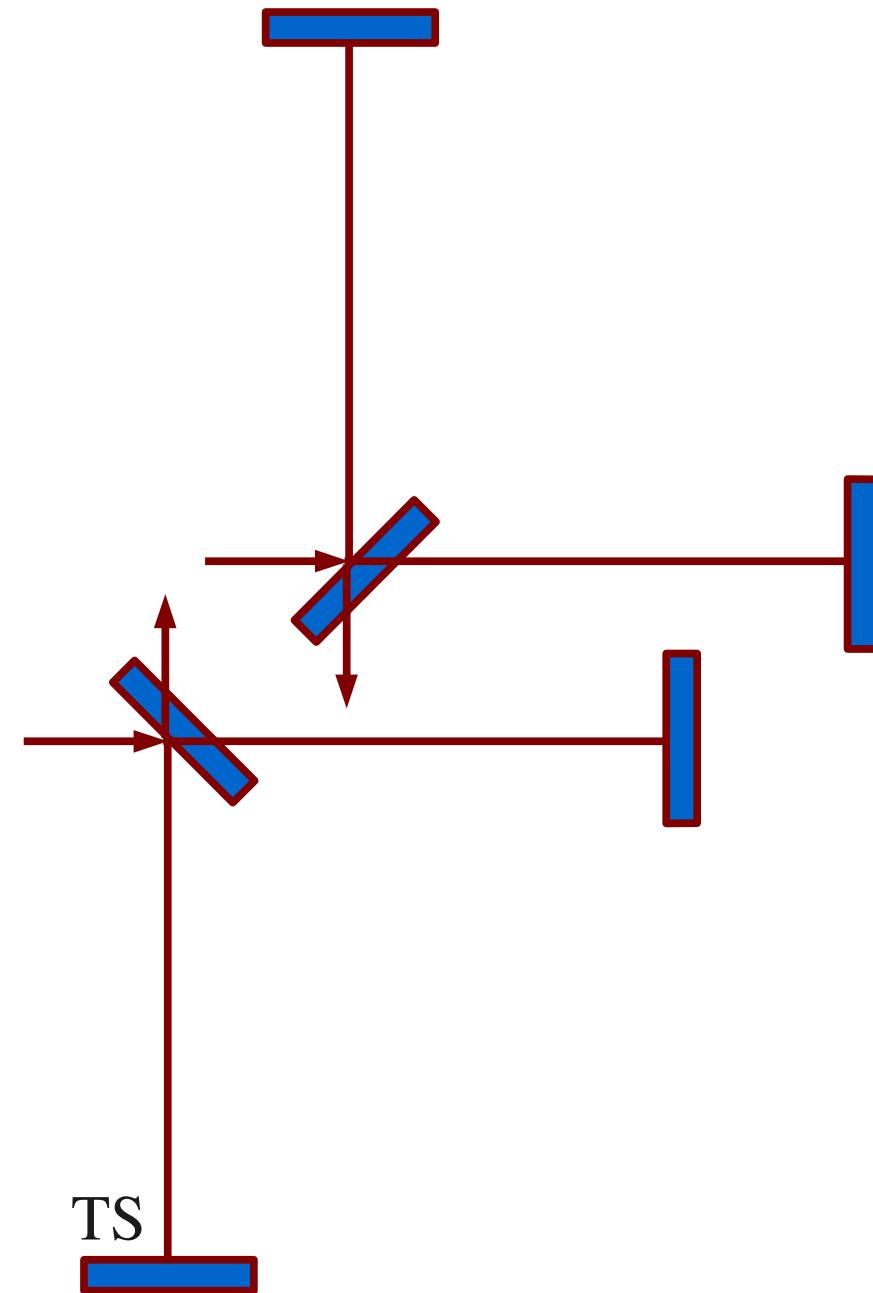
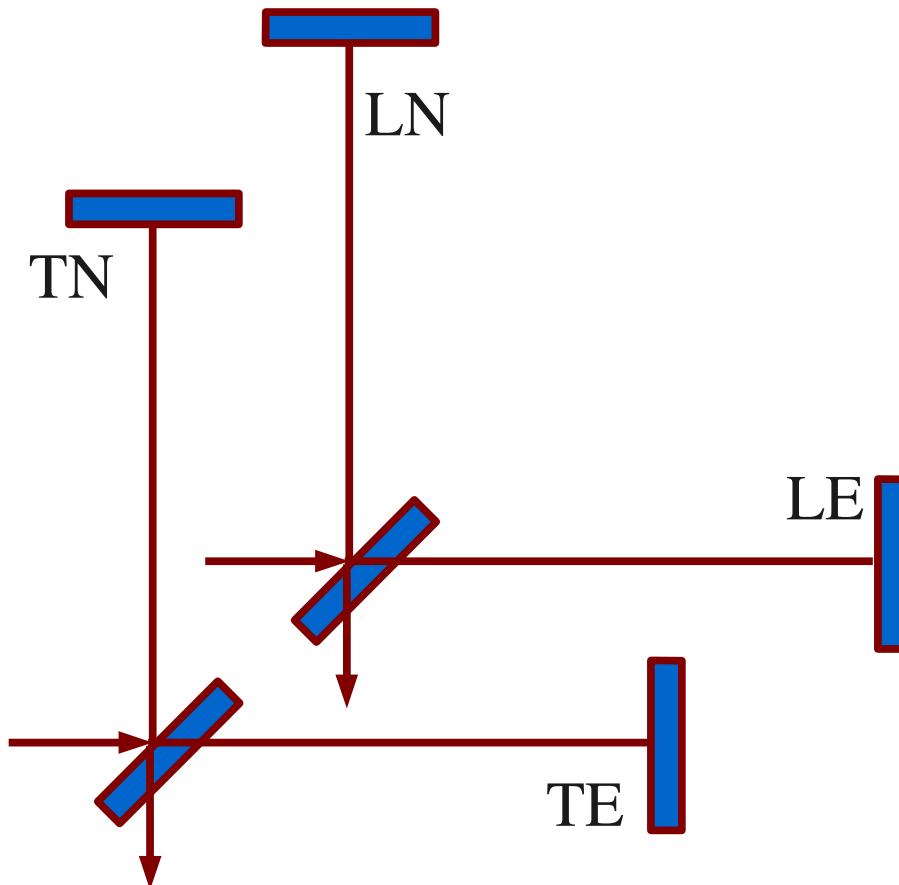
**U.Chicago:** Ben Brubaker, Evan Hall, Steve Meyer (co-PI), Bobby Lanza, Lee McCuller, Jennifer Zelenty

**Vanderbilt:** Brittany Kamai

**U. Michigan LIGO:** Dick Gustafson

# Two Configurations

Holographic Signal Correlation  $\sim 1$       Holographic Signal Correlation  $\sim 0$



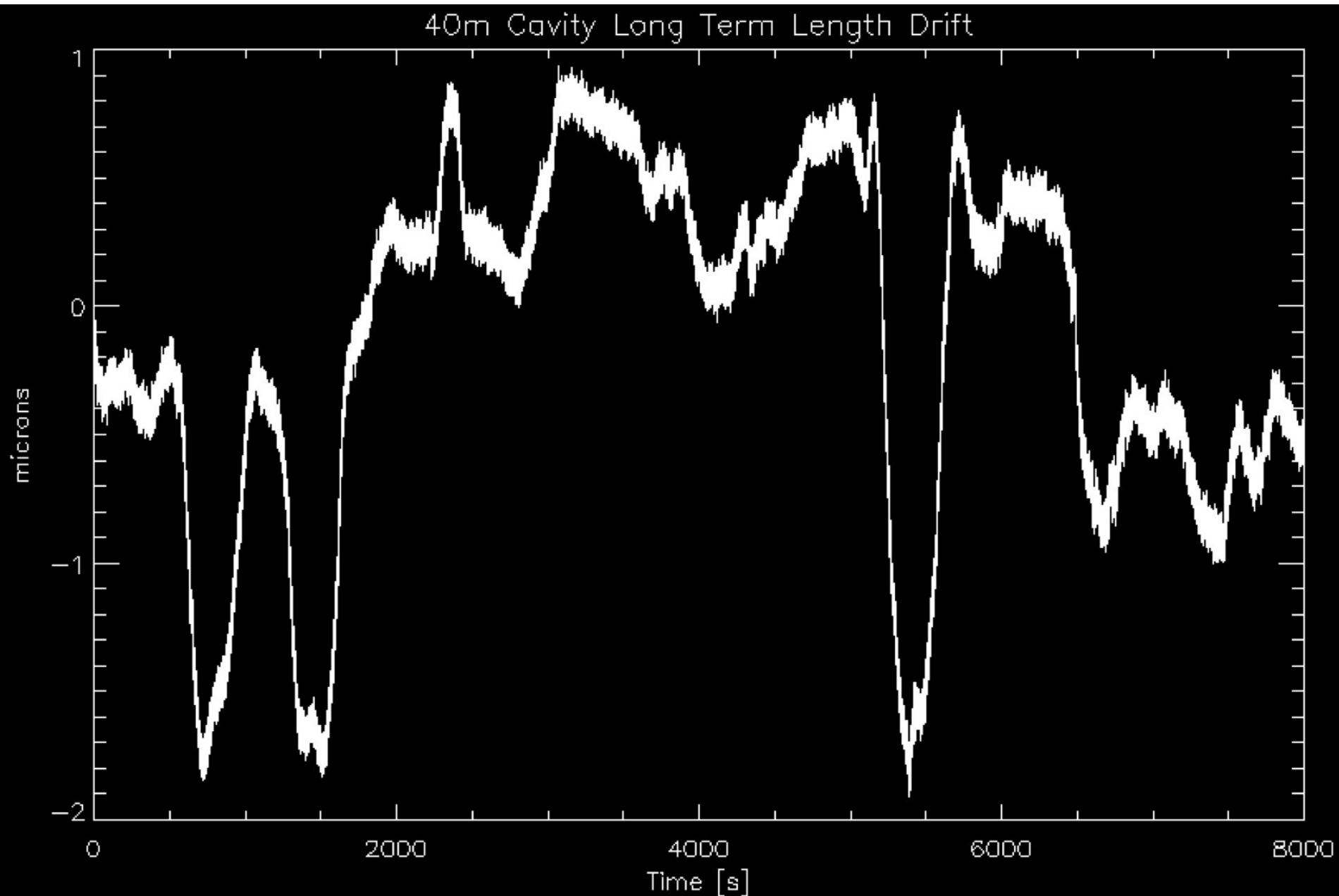
# The View from 50,000 Ft



Aaron listed five “next steps” in his  
All Experimenters Meeting  
Presentation on May 2, 2011

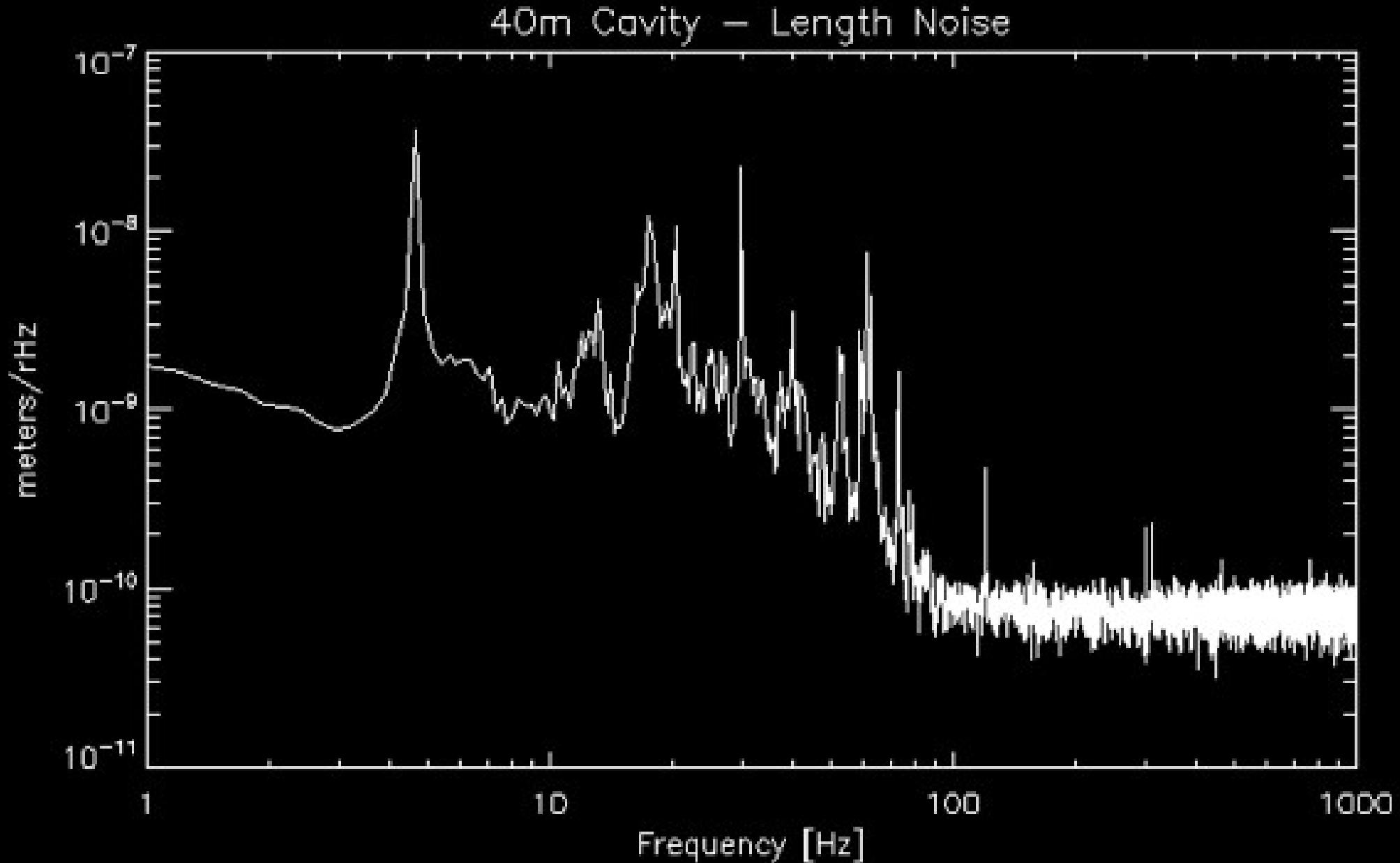
# 1/5 Refine Cavity Lock Stability

We routinely lock for hours. This plot shows the error signal fed back to the laser frequency, expressed in change in cavity length.

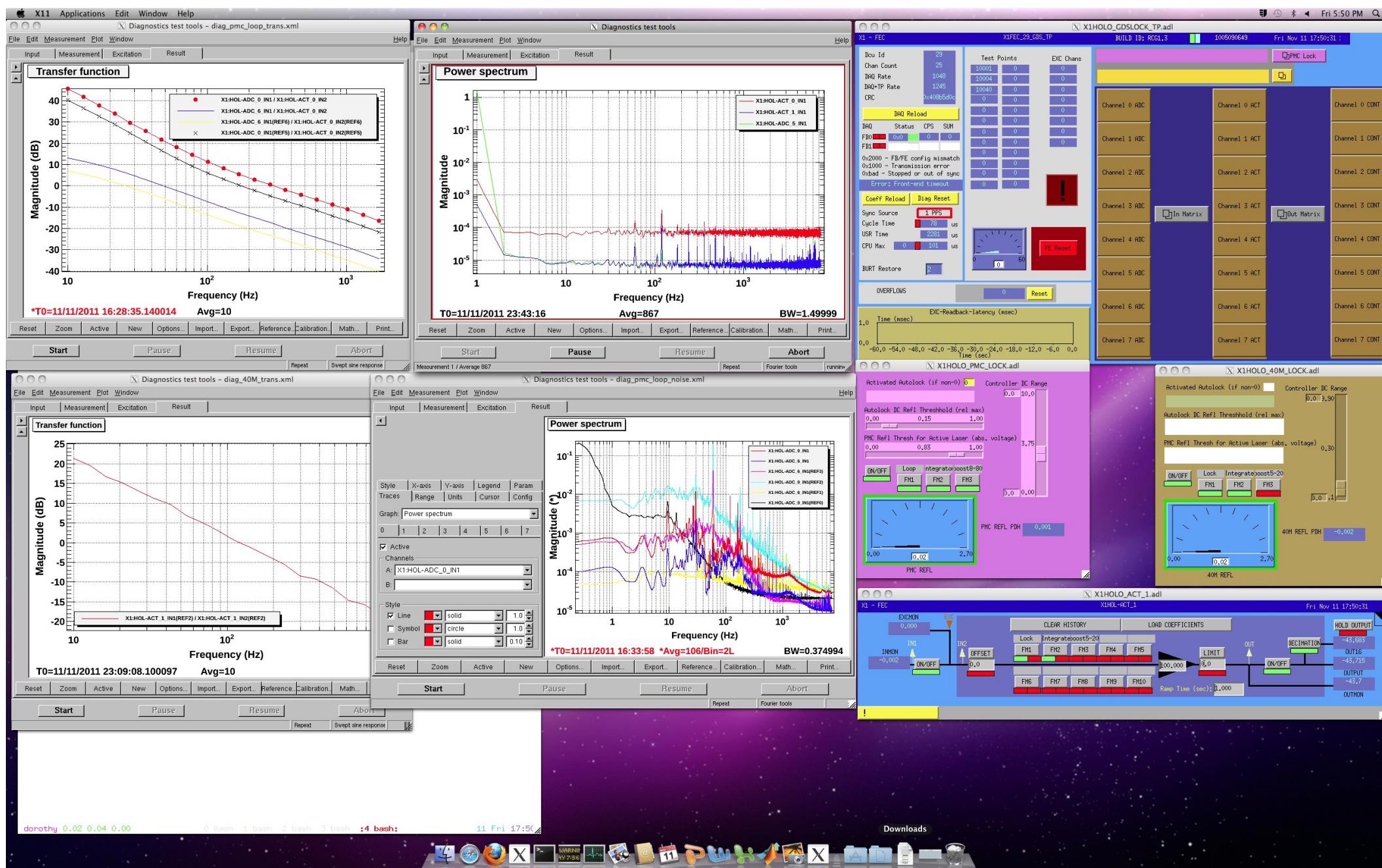


# 2/5 Measure Seismic Noise

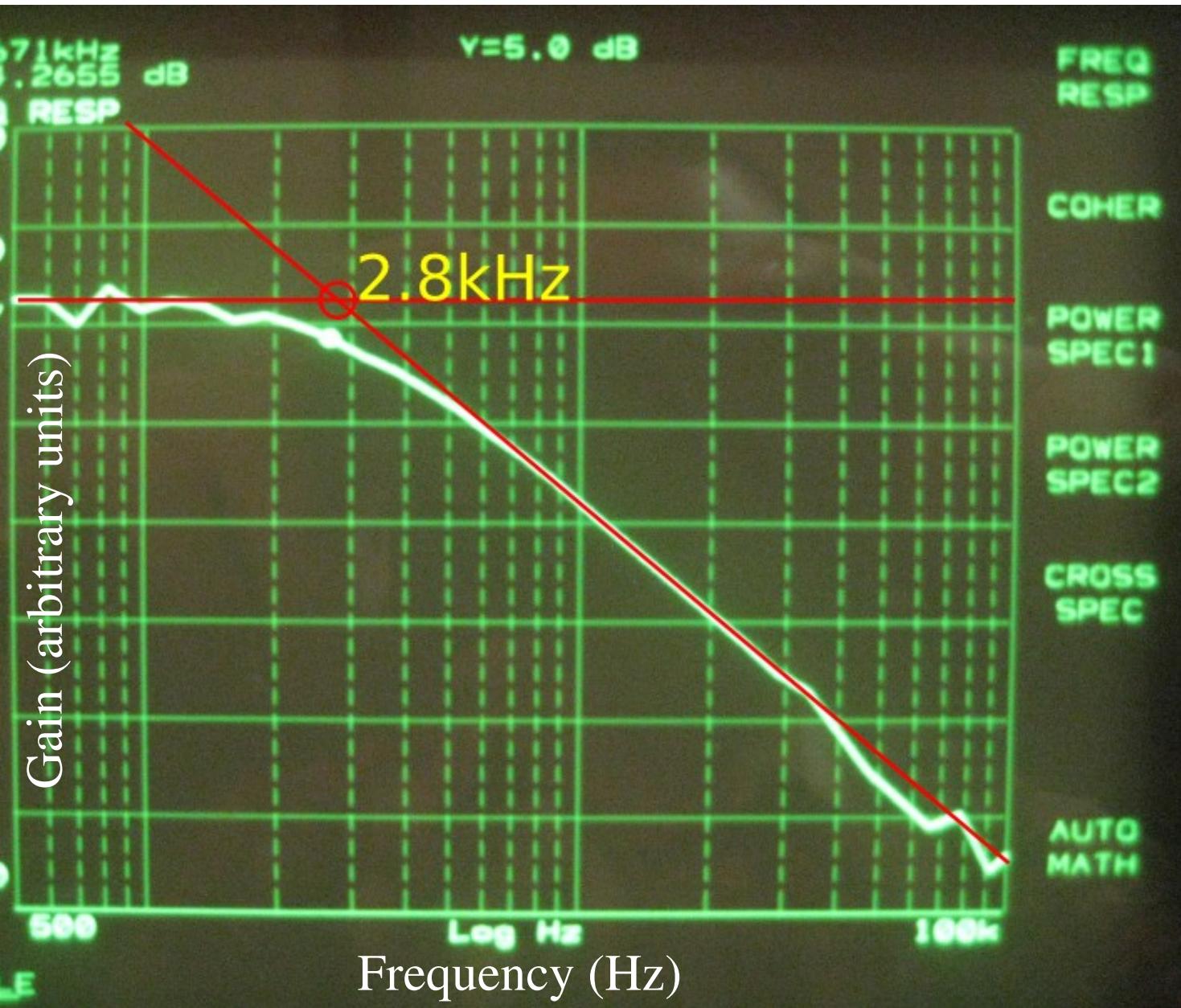
In addition to 1/f ground noise we see the cryopumps at 4.7 Hz; motors at 60 Hz.  
Above 100 Hz this is dominated by electronic and laser frequency noise.



# 3/5 Develop Digital Control system and DAQ



# 4/5 Upgrade with higher reflectivity optics to achieve higher power buildup



We replaced the input mirror with a higher reflectivity mirror.

Power build up increased from ~20 (in May) to

$$\frac{1}{1-G_{rt}} = 107 \pm 5.6$$

where

$$2\pi f_{\text{pole}} = \frac{f_{\text{FSR}} \ln(G_{rt})}{2}$$

# 5/5 Build 40m Interferometer

Concrete  
Pad and  
Piers for  
East  
Arms



# FESS, Roads and Grounds, ES&H

DONE: east hut, roll-up door and entrance way, electricity, interlock design

TODO: inside stairs, interlock



# AD Vacuum Group

DONE: assemble and test three arms; assemble RGA and bake manifolds

TODO: assemble two arms; bake all arms;

assemble 4 end stations and 2 beam splitter stations

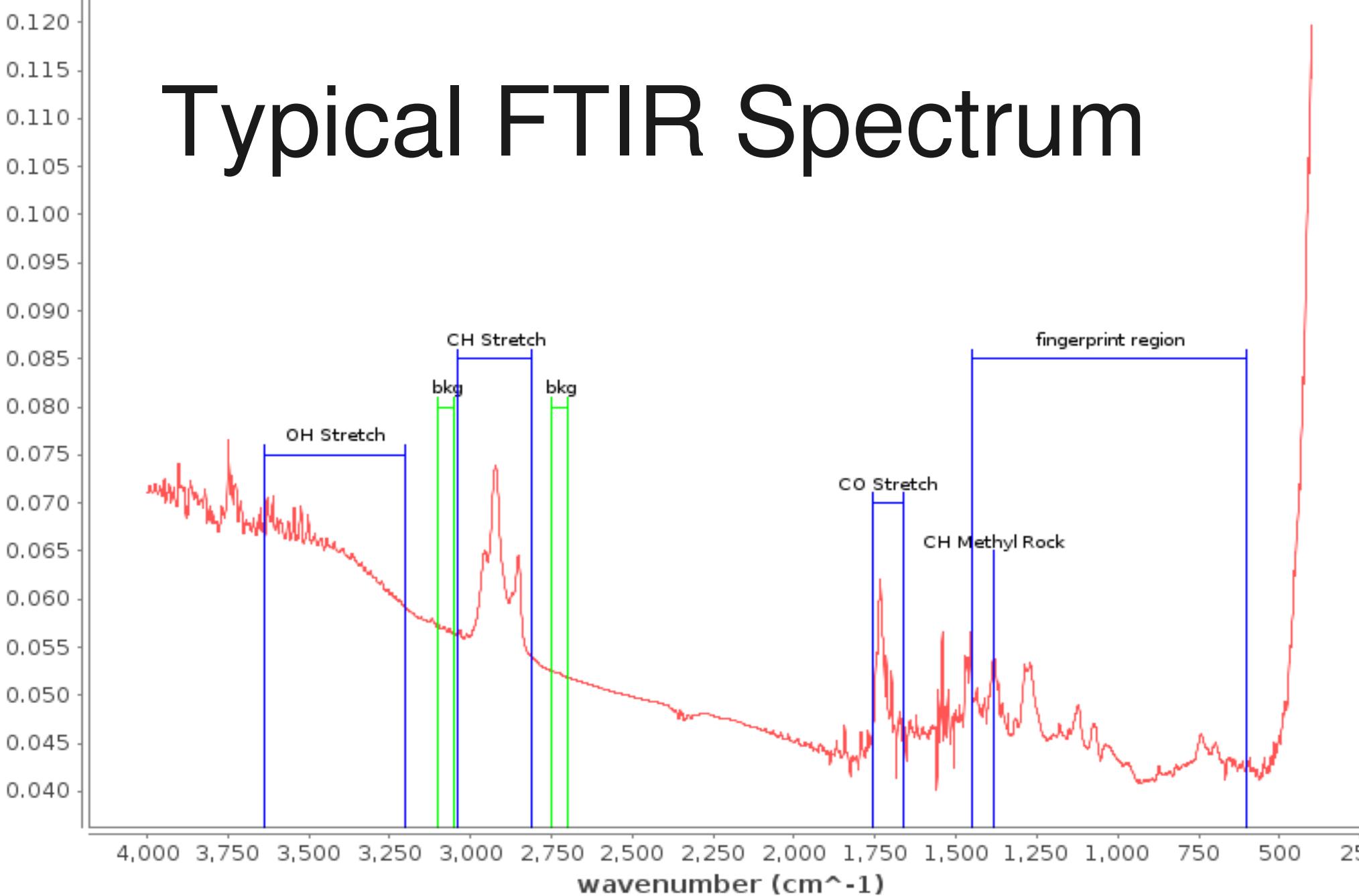


Our contract with Thermionics includes non-volatile residue samples to measure the amount of Hydrocarbons contaminating the surface, measured with an infrared absorbance spectrum. We require < 5 monolayers

Thermionics performs an independent gravimetric analysis as part of their internal QA program.

# Typical FTIR Spectrum

Absorbance



# PPD Alignment Group

DONE: define beam lines; position one beam splitter station; rough align 2 arms

TODO: final align of five arms and one more beam splitter station



# Status/Schedule

- Completed
  - Civil Construction (except for one set of stairs)
  - 2 40-meter arms and beam splitter station
- Next Steps
  - Expand area covered by interlocks
  - Launch laser from table to beam splitter station
  - Bake two arms; assemble end station; configure beam splitter station; install mirrors in first interferometer
  - Control one interferometer
- The step after
  - Build out second interferometer (and move “third” arm of T)
  - Control two interferometers
  - Measure correlation in two configurations